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Japanese Published Unexamined (Kokai) Patent Publication No. S58-164157; Publication Date: September 29, 1983; Application No. S57-47981; Application Date: March 25, 1982; Int. Cl.³: H01M 8/04; Inventor(s): Yasuo Takeuchi et al.; Applicant: The Kansai Electric Power Co., Ltd.; Japanese Title: Nenryou Denchi no Ondo Seigyo Houshiki (Temperature Control System for a Fuel Cell)

Specification

1. Title of Invention

Temperature Control System for a Fuel Cell

2. Claim

A temperature control system for a fuel cell that generates power by taking a fuel and air and in that a portion of air discharged from an air chamber of the fuel cell is supplied into the air chamber after it has been recirculated and mixed with fresh air, characterized in that a control valve that controls the amount of recirculated air is provided on a recirculation passage; the control valve is controlled so that the outlet temperature of the air chamber falls into a predetermined temperature range.

3. Detailed Description of the Invention

As for a fuel, for example, pure hydrogen or a hydrogen enriched gas wherein a natural gas is reformed, and a fuel cell that uses an air gas that oxidizes the fuel as a reaction gas, the invention pertains to a temperature control system that eliminates a heat generated along with a power generation.

As for a cooling system for the fuel cell, there are the following systems: a water cooling system; an air cooling system that uses the air gas per se, which contributes to the

reaction. An optimal system is selected according to the type of the fuel cell. Since these cooling systems originally aim an energy saving, the necessary power of auxiliary devices for cooling is desirably to be minimized. On the other hand, the control system needs to be as simple as possible.

The invention pertains to the air cooling system among these cooling systems.
However, prior art air cooling systems do not always satisfy the aforementioned conditions.

More specifically, Fig.1 is a block diagram illustrating prior art air cooling system. Reference number 1 refers to a fuel cell. Fuel cell 1 comprises the following components: a fuel chamber 2; a fuel electrode 3; an electrolyte chamber 4; a pneumatic electrode 5; an air chamber 6. An actual fuel cell, for example, a phosphoric acid type fuel cell is formed while laminating a large number of single cells using a gas section or diffusion member called a bipolar plate or a porous plate with a rib. The principle is shown in Fig.1. A fuel is supplied in fuel chamber 2 as indicated by an arrow. The flow rate and the pressure are controlled at predetermined conditions. The description of the operation is neglected because it is not directly related to the invention. As in electrolyte chamber 4, when a matrix fuel cell that uses acidic electrolyte is used, it is fixed to the matrix. When an alkaline electrolyte is used, it is circulated so as to eliminate produced water. The arrow in the drawing indicates the flow of the circulation.

Air is supplied in air chamber 6. When the air cooling system is used, air at a several time larger amount of air that is necessary for the reaction is supplied. Reference number 7 refers to an air blower, which sends fresh air. The major portion of the air that got out of air chamber 6 is branched in a recirculation passage 8. The remaining air is used

for other uses or exhausted. The air branched in recirculation passage 8 is cooled or preheated at a heat exchanger 9. The cooled or preheated air is then mixed with fresh air via an air blower. The mixed air is sent to air chamber 6 again.

As in prior art air cooling system as mentioned above, it is necessary to provide heat exchanger 9. In order to effectively use a heat energy collected by the heat exchanger, various types of control and also auxiliary devices that require energies for the control need to be provided.

The invention is produced to eliminate the aforementioned disadvantages of prior art system. The invention also aims to offer a cooling control system that does not require an auxiliary device with a high consumptive energy at a lower cost.

According to the invention, the purpose is achieved by providing the control valve on the recirculation passage and by controlling it based on the outlet temperature of the air chamber of the fuel cell.

Fig.2 illustrates an embodiment of the invention. The same reference number indicates the same component of Fig.1. A control valve 11 is inserted in the recirculation passage in lieu of heat exchanger 9. Control valve 11 is controlled by a controller 13 that generates a control output based on the output of a temperature detector 12 that detects the output temperature of air chamber 6 of fuel cell 1. Controller 13 controls the mixing ratio of fresh air to recirculating air so that the output temperature of air chamber 6 becomes an optimal temperature as a whole. In this case, as the inlet temperature of the air chamber also needs to be set within a predetermined temperature range so as to achieve a sufficient operation for the fuel cell, it is preferably detected as needed so as to control

control valve 11 so that both inlet and outlet temperatures fall into a desired temperature range.

According to the invention, the capacity of air blower 7 becomes slightly larger. However, even if the temperature of fresh air changes or even if the amount in the power generation of the fuel cell increases or decreases, the temperature of the fuel cell is automatically maintained at a sufficient temperature. By this means, the heat exchanger necessary for prior art system can be omitted. Additionally, no special controller or auxiliary device is required. Therefore, an extremely practical effect is obtained with respect to the price and the energy consumption.

4. Brief Description of the Invention

Fig.1 illustrates a fluid circuit as in an example of prior art system. Fig.2 illustrates a fluid circuit as in an embodiment of the invention.

1...Fuel cell

6...Air chamber

7 and 10...Air blowers

8...Recirculation passage

11...Control valve

12...Temperature detector

13...Controller

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